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--22. (New) The semiconductor device according to claim 13, wherein an intermediate layer is interposed between said saturable absorbing layer and said one of said first cladding layer and said second cladding layer;

said first cladding layer, said second cladding layer, and said intermediate layer comprise one or more group-V elements selected from a group consisting of As, P, and Sb; and

said first cladding layer, said second cladding layer, and said intermediate layer do not substantially include N.--

REMARKS

The application has been reviewed in light of the Office Action dated September 26, 2002. Claims 1-6 and 13-18 were pending in this application, with claims 7-12 having been withdrawn from consideration. New claims 19-22 have been added, and claims 2-5 have been amended hereby. Accordingly, claims 1-6 and 13-22 are presented for examination, with claims 1, 13, 19 and 20 being in independent form. It is submitted that no new matter has been added by the present amendment.

Claims 1-4, 6, 13-16, and 18 were rejected under 35 U.S.C. § 102(e) as being allegedly anticipated by U.S. Patent No. 5,974,069 to Tanaka et al. Claims 5 and 17 were rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over Tanaka et al. in view of U.S. Patent No. 6,118,800 to Kidoguchi et al. Applicant has carefully considered the Examiner's comments and the cited art, and respectfully submits that independent claims 1 and 13 are patentable over the cited art, for at least the following reasons.

Independent claim 1 relates to a semiconductor device. The device includes a semiconductor substrate of a first conductivity type, a first cladding layer of the first conductivity

type formed on the semiconductor substrate, an active layer formed on the first cladding layer, a second cladding layer of a second conductivity type formed on the active layer and a saturable absorbing layer formed on at least portions of at least one of the first cladding layer and the second cladding layer. The saturable absorbing layer is formed to have a band gap energy either approximately the same as, or slightly smaller than, the active layer, and also to be doped with a high concentration of N.

Tanaka et al., as understood by Applicant, relates to a semiconductor laser and manufacturing method thereof. The semiconductor laser uses a semiconductor of gallium nitride (GaN) type compound and is suitable for emitting blue light. An optimum material is used for a current blocking layer to obtain a semiconductor laser that satisfies a gain guiding structure of high light emitting efficiency or a refractive index guiding structure, or both, thereby facilitating control of the noise of oscillated light, control of the spread of light in a lateral direction, and control of the longitudinal mode.

As understood by Applicant, Tanaka et al. discloses the use of an absorbing layer in Embodiment 3 (see Tanaka et al., col. 18, lns. 9-40; Fig. 4). This absorbing layer is defined as "consisting of $\text{In}_r\text{Ga}_{1-r}\text{N}$ ($0 < r < 1$, where $r = 0.1$ for example)" (see id.), and functions to provide a difference in refractive index in the lateral direction of the active layer to make a refractive index guiding structure, or to cause self-oscillation (see id.).

Applicant finds no disclosure or suggestion by Tanaka et al., however, of a saturable absorbing layer that is formed to have a band gap energy either approximately the same as, or slightly smaller than, the active layer, and also to be doped with a high concentration of N, as recited in independent claim 1.

Applicant also does not find disclosure or suggestion in Tanaka et al. of use of

semiconductor material that is not comprised of GaN. N is seen to be a main element of the semiconductor device of Tanaka et al. (see id., col. 5, lns. 16-18, 26-28, 37-40, 44-47). In contrast, N is not a main element of the semiconductor device of the present disclosure.

Accordingly, for at least the above-stated reasons, Applicant respectfully submits that independent claims 1 and 13, and the claims depending therefrom, are patentable over the cited references.

The September 26, 2002 Office Action cites Kidoguchi et al. in connection with claims 5 and 17.

Kidoguchi et al., as understood by Applicant, relates to a semiconductor laser and cleaving method. According to Kidoguchi et al., independent cladding layers are located adjacent to a saturable absorbing layer (see Kidoguchi et al., Figs. 1A, 8). That is, the saturable absorbing layer of Kidoguchi et al. is in direct contact with the cladding layers.

Applicant finds no teaching or suggestion in Tanaka et al. or in Kidoguchi et al., however, that an intermediate layer is interposed between the cladding layer and the saturable absorbing layer, as recited in claims 5 and 17.

Attached hereto is a version with markings to show changes made to the claims by the present amendment.

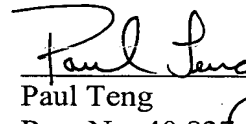
The Office is hereby authorized to charge any additional fees that may be required in connection with this amendment and to credit any overpayment to our Deposit Account No. 03-3125.

If a petition for an additional extension of time is required to make this response timely, this paper should be considered to be such a petition, and the Commissioner is authorized to charge the requisite fees to our Deposit Account No. 03-3125.

If a telephone interview could advance the prosecution of this application, the Examiner is respectfully requested to call the undersigned attorney.

Entry of this amendment and allowance of this application are respectfully requested.

Respectfully submitted,



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IN THE CLAIMS

Claims 2-5 have been amended as follows, and new claims 19-22 have been added as set forth below:

--2. (Amended) The [self-pulsating] semiconductor [laser] device according to claim 1, wherein said saturable absorbing layer comprises N as a group-V element.

--3. (Amended) The [self-pulsating] semiconductor [laser] device according to claim 1, wherein said active layer, first and second cladding layers and saturable absorbing layer comprise AlGaInP alloy materials; and

said saturable absorbing layer further comprises N.

--4. (Amended) The [self-pulsating] semiconductor [laser] device according to claim 1, wherein said saturable absorbing layer comprises an AlGaInNP alloy material.

--5. (Amended) The [self-pulsating] semiconductor [laser] device according to claim 1, wherein said cladding layer comprises AlGaInP and wherein an AlGaInP intermediate layer is interposed between said cladding layer and said saturable absorbing layer, said intermediate layer containing less Al than said cladding layer and no N.

--19. (New) A semiconductor device comprising:

a semiconductor substrate of a first conductivity type;

a first cladding layer of said first conductivity type formed on said semiconductor

substrate;

an active layer formed on said first cladding layer;

a second cladding layer of a second conductivity type formed on said active layer; and

a saturable absorbing layer formed on at least portions of at least one of said first cladding layer and said second cladding layer,

wherein said saturable absorbing layer is formed to have a band gap energy either approximately the same as, or slightly smaller than, said active layer, and also to be doped with N in an amount sufficient to form a localized level.

--20. (New) A semiconductor device comprising:

a semiconductor substrate of a first conductivity type;

a first cladding layer of said first conductivity type formed on said semiconductor substrate;

an active layer formed on said first cladding layer;

a second cladding layer of a second conductivity type formed on said active layer; and

a saturable absorbing layer formed on at least portions of at least one of said first cladding layer and said second cladding layer,

wherein said saturable absorbing layer is a mixed crystal of N with another group-V element such that an N content is in a specific range corresponding to a band gap narrower than a band gap of a mixed crystal that does not include N; and

said saturable absorbing layer is formed to have a band gap energy either approximately the same as, or slightly smaller than, said active layer.

--21. (New) The semiconductor device according to claim 1, wherein an intermediate layer is interposed between said saturable absorbing layer and said one of said first cladding layer and said second cladding layer;

said first cladding layer, said second cladding layer, and said intermediate layer comprise one or more group-V elements selected from a group consisting of As, P, and Sb; and

said first cladding layer, said second cladding layer, and said intermediate layer do not substantially include N.

--22. (New) The semiconductor device according to claim 13, wherein an intermediate layer is interposed between said saturable absorbing layer and said one of said first cladding layer and said second cladding layer;

said first cladding layer, said second cladding layer, and said intermediate layer comprise one or more group-V elements selected from a group consisting of As, P, and Sb; and

said first cladding layer, said second cladding layer, and said intermediate layer do not substantially include N.--

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Takashi TAKAHASHI

Serial No.: 09/408,437

Examiner: A. Rodriguez

Filed: September 29, 1999

Group No.: 2828

For: SEMICONDUCTOR DEVICE WITH
SATURABLE ABSORBING LAYER

Date: December 26, 2002

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Transmitted herewith is an Amendment Under 37 C.F.R. 1.115 in the above-identified application.

☐ No Additional fee is required.☒ The fee has been calculated as shown below.☐ This is an application of a small entity under 37 CFR 1.9(f), and the amounts shown in parentheses apply.16 Total Claims in excess of 20 previously paid for, at \$18 (\$9)4 Ind. Claims in excess of 3 previously paid for, at \$84 (\$42)Additional Fee for this Amendment \$84.00

This Response is being filed within the first month, second month, third month, fourth month following the expiration of the term originally set therefor, and applicant Petitions for an extension and the fee of \$110 (\$55), \$400 (\$200), \$920 (\$460), \$1,440 (\$720) is due and paid herewith.

☒ A check in the amount of \$84.00 is attached.☐ Charge \$ to Deposit Account No. 03-3125.

Please charge any additional fees incurred by reason of this Response or credit any overpayment to Deposit Account No. 03-3125. A duplicate copy of this sheet is enclosed.

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